The most pronounced results arose from the feeding of young animals with material derived from young animals.

Although some histologic evidence exists indicating the glandular nature of the pineal in mature adult life, such material, when fed to young animals, did not bring about the changes observed in feeding with younger pineal material.

At no time has gigantism been produced. As adult life is approached, pineal feeding is less effective.

The excess growth of young animals under pineal feeding is grossly symmetrical. No disproportion has been observed except a possible hypertrophy of the testes noted in some

TABLE 4.—ANALYSIS OF GAINS BY SEX (Series B)

Weeks	Control, 2 Weeks Old				Pineal, 2 Weeks Old			
	Males		Females		Males		Females	
	Aver., Gm.	Gain, Gm.	Aver., Gm.	Gain, Gm.	Aver., Gm.	Gain, Gm.	Aver., Gm.	Gain, Gm.
	200.9	....	205.9	....	204.5	....	208.4	....
1	200.0	—0.9	192.0	—13.9	203.2	—1.3	211.9	3.5
2	219.9	19.9	219.8	27.8	249.0	45.8	224.9	13.0
3	251.5	31.6	224.4	4.6	284.1	35.1	242.3	17.4
4	277.7	26.2	250.1	25.7	309.9	25.8	259.1	16.8
5	295.5	17.8	266.2	16.1	331.8	21.9	277.4	18.3
6	296.7	1.2	262.7	—3.5	342.1	10.3	282.8	5.4
7	326.2	29.5	288.6	25.9	373.3	31.2	305.2	22.4
8	345.3	19.1	305.5	16.9	401.5	28.2	325.2	20.0
9	360.9	15.6	314.0	8.5	409.8	8.3	326.1	0.9
10	402.2	41.3	349.4	35.4	452.2	42.4	371.4	45.3
11	417.5	15.3	367.8	18.4	479.0	26.8	387.4	16.0
12	427.4	9.9	379.7	11.9	482.8	3.8	402.5	15.1
13	433.3	5.9	383.4	3.7	488.5	5.7	421.6	19.1
14	458.1	24.8	413.9	30.5	522.4	33.9	444.3	22.7

	Males	Females	Males	Females
Last weight....	458.1 gm.	417.9 gm.	522.4 gm.	444.3 gm.
Initial weight..	200.9 gm.	205.9 gm.	204.5 gm.	208.4 gm.
Average gain...	257.2 gm.	212.0 gm.	317.9 gm.	235.9 gm.
Gain per cent...	128.0	103.0	155.4	113.2

Excess pineal males over control males..... 27.4 per cent.
Excess pineal females over control females..... 10.2 per cent.

animals. In microscopic sections, such testes are seen to be made up of larger and more mature tubules than in controls of the same age, but with no increase in the interstitial tissue.

Both males and females are affected by pineal administration, but the gains (in relation to respective controls) have been greater for the males than for females.

THE INFLUENCE OF PINEAL FEEDING ON SEXUAL MATURITY

Of any several groups of premature guinea-pigs maintained under normal conditions, it is assumed that individuals will attain to sexual maturity near the same time and will give birth to young at about the same subsequent time. In case of a regularly recurring marked difference in time of birth of first young in one phase of an experimental lot of animals, it is rational to associate this phenomenon with different times of attaining to maturity. On such a basis it has been noted in all groups of animals which were allowed to breed that the pineal-fed mothers gave birth to young earlier than the controls. One series including forty-five animals was carefully conducted with a view to any data bearing on the matter in question. The two sexes were kept together from birth. The feeding with veal pineal tissue was continued for fourteen weeks. During this time the pineal-fed attained to a size 32 per cent. larger than their controls of the same ages. The female farthest advanced in pregnancy among the pineal-fed animals aborted, so that the date of birth of first young was not determined. The first normal birth occurred July 3 in the experimental group. Others of the same group followed until over half the females had given birth to young. Then three weeks and two days later, July 26, the first control pig was born. The progeny in all instances were like any other pigs. After all pigs were born in both groups and after an interval of several weeks, the same females were placed with normal bucks to detect a possible difference in the second pregnancy. No such difference was detectable.

GENERAL SUMMARY

From the foregoing experiments, evidence of the precocity of development usually attributed to pineal deficiency (hypopinealism) has been obtained in animals by supplying an increased amount of pineal substance by feeding or injecting pineal preparations. Such administration of pineal substances led to a more rapid growth of body than normal, and determined an early sexual maturity. The excess in rate of growth was most pronounced (40.9 per cent. excess in eleven weeks) in *young* animals fed with pineal tissue obtained from *young* animals. No tendency to gigantism has followed pineal administration. After maximum size was attained, pineal administration appeared to be ineffective. Both males and females respond to the influence of pineal substances in rate of growth, but the response has been more definitely manifested in males.

472 Pennsylvania Avenue.

DUODENAL ALIMENTATION

M. H. GROSS, M.D.
AND
I. W. HELD, M.D.
NEW YORK

The internal treatment of gastric and duodenal ulcer is rightly receiving widespread attention.

Most modifications of the old established methods are founded on the same principle, namely, to rest the stomach as much as possible until the acute symptoms disappear, to reduce secretions, and to bind the existing secretions. Such procedure, if effectively carried out, is favorable to the healing of the ulcer. It is essential, of course, to observe the treatment most minutely and persistently. Boas and others are right when they state that the reason so many uncomplicated ulcers are receiving surgical treatment is that general practitioners, and to some extent even specialists, do not sufficiently await results from the internal treatment. One often hears that a decision as to whether a gastric or duodenal ulcer should receive medical or surgical treatment depends on the circumstances of the patient. It is sometimes asserted that in the case of persons who must earn their daily bread and have not the time to undergo a regular ulcus treatment, it is best to operate.

That this argument is not logical is self evident. First, surgical treatment involves a longer time than the medical for a complete cure. Secondly, the final results of surgical treatment of uncomplicated ulcer are no more favorable than those of medical treatment. Finally, the direct mortality danger involved in operative procedure, even if only a gastro-enterostomy is done, is still from 2 to 4 per cent. It is a great advantage, therefore, to find a therapeutic agent which promises to be an additional aid in the internal treatment of gastric and duodenal ulcer. Duodenal alimentation may prove to have the desired effect.

DUODENAL FEEDING

Max Einhorn[1] advised feeding by means of the duodenal tube, and indicated such feeding in all cases in which it is desired to rest the stomach and in which, for some reason, the food is not retained or well

1. Einhorn, Max: Med. Rec., New York, July 16, 1910.

borne by the stomach. Indications include ulcus ventriculi or duodeni, marked cases of ptosis and atony, cirrhosis of the liver, nervous vomiting and persistent vomiting of pregnancy, and inoperable cancer of the stomach. Lately Einhorn observed that the duodenal tube has no injurious effect even in acute bleeding of the stomach or duodenum.

Einhorn and Rosenbloom[2] found that duodenal feeding maintains the nitrogenous equilibrium.

The length of time during which such feeding was carried on was from eight to fifteen days. The food used consists of from 240 to 300 c.c. of milk at body temperature, one raw egg, and 15 grains of lactose. This quantity is introduced every two hours. In order to increase the quantity of fluid Einhorn administers a saline solution by rectum, by means of the Murphy drop method, or water is given by the duodenal tube drop by drop. If the lactose causes diarrhea, it is discontinued. If the milk is not borne well, strained barley, or strained pea soup is sometimes given. Feeding should be administered very slowly, each feeding lasting for twenty minutes.

The first two or three days there is apt to be some nausea or retching, a sensation of distention, and even the vomiting up of the tube. Einhorn prefers the use of a thin tube because it is tolerated better by the patient. He states, however, that the food is not so easily introduced through a narrow as through a wide tube.

This method of feeding seems to be a happy idea, as it gives us a chance, if possible, to replace rectal feeding in the great majority of cases in which the stomach is to be put to rest, and at the same time to introduce sufficient food directly into the small intestine, where it can well be digested and absorbed. It is essential, however, to have an exact understanding of the physiology of digestion and absorption in that part of the small intestine with which the food is brought into contact. With this in mind we are enabled to judge the kind of food, the quantity, and how it should be given.

THE INTESTINAL SECRETIONS

It will be remembered that the intestinal juices contain a number of ferments; erepsin breaks up the products of protein digestion by pepsin and trypsin, into the end-products of amino-acids, and acts directly on the casein. Lipase, the fat-splitting ferment, exercises its action on the finely emulsified fats. Of the carbohydrate ferments, the intestinal juices contain lactase, maltase and invertin. There is also present a nuclease. We therefore see that ferments do exist in the small intestine, to act on a number of important foodstuffs essential to life.

It is likewise known through the studies of Pawlow and his pupils, as well as those of Cohnheim and his co-workers, that the intestinal juices are stimulated by local irritation, but that the ferments are not increased with the quantity of secretions.[3] If, however, food is directly introduced into the intestine, secretions with corresponding ferments are stimulated. This in itself would justify duodenal feeding. But the ferments in the intestine are primarily not so extensive in their action as those of the pancreatic juice, and for predigestion the ferments of the pancreatic juice are undoubtedly essential, even if the food is directly introduced into the small intestine. Drawing our conclusions from the experimental evidence furnished by the studies of Hamburger, Heckman, Babkin and others (who found that absorption of intestinal juices in one part of the small intestine stimulates secretion of active intestinal juices in another part reflexly by way of the nervous system, or by way of the blood), it is reasonable to assume that when food is directly introduced to the small intestine, pancreatic secretion is stimulated and aids in digestion.

That stimulation—even of the rectum—by food causes secretion in the stomach is an established fact, and would tend to substantiate our assertion. If gastric secretions are likewise stimulated by duodenal feeding, the rest intended for the stomach is not a complete one. But the disturbing element of these secretions is to a great extent removed, first, because the local irritant, the tube in the stomach, causes an abundant mucus secretion which neutralizes the acid; this is proved by the fact that after the tube is removed, thick layers of mucus surround the tube; secondly, the secretions in the stomach in the absence of any food gradually diminish in acidity, and lastly, through the open pylorus, bile and pancreatic juice regurgitate and so lower the acidity. Such factors in the stomach tend to diminish peristalsis or completely do away with it, thereby establishing complete rest.

The rhythmic contractions in the small intestine have, according to Cannon, the object of making the digestive juices more accessible to the food. Experiments demonstrate that if food reaches the intestine not predigested by stomach and pancreatic juices, these rhythmic contractions are slower, thereby allowing the intestinal juice to adapt itself to its unaccustomed task.

Considering the foregoing facts — the existence of the ferments in the small intestine, their increase as a response to the local introduction of food, and the accommodation of the rhythmic contractibility of the small intestine to the contents — it is easily conceived that direct feeding by means of the duodenal tube is a very plausible means of supplying enough calories to maintain body weight. However, as the food introduced directly into the small intestine is primarily foreign to that part of the viscus, our aim must be to give the viscus the opportunity to adapt itself. This is accomplished by administering such food at the beginning of the feeding as is most easily digested and most completely absorbed. It may consist of the following:

Of the proteins, it is the casein of the milk that is completely digested by the erepsin; the lactose is acted on by the lactase; the finely emulsified fat of the milk is acted on by the lipase of the small intestine. The water and the salts of the milk are also readily absorbed there. Of the carbohydrates, the monosaccharids are absorbed in solution of from 6 to 8 per cent. A difference exists in the absorbability of the various kinds of monosaccharids. Glucose and galactose are more quickly absorbed than levulose and mannose. Maltose and glucose completely disappear within an hour, while of the lactose in equal quantity, only 26 per cent. is absorbed.

During the first period of feeding, milk as well as from 6 to 8 per cent. of glucose solution is the most rational form of feeding. After three days we increase the caloric value by increasing the fat, in the form of yolks of egg, which at the same time carries to the

2. Einhorn and Rosenbloom: Am. Jour. Med. Sc., 1913, cxlii, 7.
3. Savage: Dissert., St. Petersburg, 1904, p. 6.

system lecithin and phosphorus. Pure cream is best given in small quantities, and even then if not borne well (as manifested by diarrhea) it is best to add pankreon to the cream in a formula given below. After the sixth day the whole egg is usually borne well. The feeding is administered by means of the Einhorn or Gross duodenal tube.

THE APPARATUS

As the use of the duodenal tube is not occupying the position it deserves, it will not be out of place here to mention briefly the difference which exists between the Einhorn and the Gross tube and the mode of introduction of the Gross tube, which we use exclusively.

The Einhorn tube is narrower and the ball is much lighter in weight, 2.5 gm., while the Gross tube has a diameter of 7 mm. and the ball is much heavier, from 10 to 11 gm. in weight. The Einhorn tube is introduced with the patient sitting, and the propulsion of the little ball into the duodenum is dependent on the propulsive action of the stomach.

The Gross weighted tube works its entire way by gravity; hence the position of the patient is varied, while the tube is being introduced, in order to favor gravitation of the ball. Originally Gross advised the following mode of introduction:

The patient assumes a comfortable position in an armchair, with the head slightly inclined backward, so as to let the ball fall back toward the posterior pharyngeal wall.

The patient, having well moistened the ball with his saliva, is told to swallow it as he would a pill. As soon as the ball has arrived at the posterior faucial wall, the patient is requested to swallow energetically a few times. At the same time we rapidly push the tube in, in order to facilitate the ball gliding down. It is important that the patient's act of swallowing and the act of pushing in the tube be executed simultaneously, as otherwise the ball will be returned again and again by retching.

With this manipulation there is no need for the patient to wash the ball down with a drink of water. We have always been able to dispense with water. Slight cyanosis, due to spasm at the entrance to the larynx, is quickly overcome. Once the narrow place is passed, there is no further obstacle to the advance of the tube. When the tube has been swallowed down to mark 45 cm., we convince ourselves of the unimpeded passage by lightly blowing into the tube. Should there be an obstruction, caused by kinking, it is rapidly overcome by slightly withdrawing the tube.

As soon as the patient has assumed the right decubitus, the tube is gently pushed forward, rather following the traction of the ball. The tube is allowed to glide in to mark 70 cm. (about 10 cm. beyond the pyloric ring), in order to have a sufficient length of tube hang in the gastric cavity, enabling the ball to work its way onward.

At this juncture the patient is instructed to hold the tube in position by slightly biting on it for from one half to three quarters of an hour, in fact, long enough to allow the ball to enter the duodenum. Pushing the tube still farther in before this time has elapsed would simply cause it to roll up in the stomach, frustrating the entire procedure.

During this time the patient usually falls asleep, while the physician may attend to other duties. When the one half or three quarters of an hour has expired, the contents are aspirated from time to time until characteristic duodenal juice appears in the receptacle, which is usually the case after from half an hour to an hour.

This, our method of introducing the apparatus, entirely circumvents the fundus action of the stomach, as it brings the little ball at once to that part of the stomach — the pars pylorica — which alone is concerned in the propulsion of its contents.

Holzknecht of Vienna[4] and Lippman of San Francisco[5] modified the mode of introducing the Gross duodenal tube as follows: The tube is swallowed up to 45 cm. with the patient in a sitting position; the patient then climbs on the table on all fours and turns immediately on his right side with head and chest elevated. In this position the tube is introduced to 70 cm. After five minutes he is placed on his back with elevated pelvis. After another five minutes the tube is pushed down further to 80 cm. In five minutes more, the duodenal contents can as a rule be obtained. According to the authors mentioned, it takes from fifteen to twenty minutes for the tube to reach the duodenum.

For the Einhorn tube to reach the duodenum, the minimum time is from three to four hours; the maximum from ten to twelve hours, because the tube relies entirely on the propulsive action of the stomach. The narrower tube is considered an advantage by Einhorn because it causes less irritation; on this theory Palewski devised a duodenal tube which Holzknecht and Lippman rightfully term a combination of the Einhorn tube and the Gross ball. We have never observed any irritation caused by the larger tube, and, for convenience in feeding, Einhorn himself states that a larger sized tube facilitates the introduction of food. In spite of the best method, it sometimes happens that the ball halts before a closed spastic pylorus. In such cases it is found practical to introduce through the tube a few tablespoonfuls of olive oil, which neutralizes the hydrochloric acid and facilitates the opening of the pylorus. It is essential to introduce the tube as far as from 120 to 125 cm. in order that it may not slip back during the entire time the tube is in the small intestine.

MODE OF FEEDING

Before food is introduced, we ascertain by blowing that the lumen is patent, and that the tube is in the intestine, by aspirating the intestinal contents. The food is introduced through a glass funnel attached to the outer end of the tube. It is essential, as already stated by Einhorn, that the food be given very slowly. With the Gross tube, each feeding can be accomplished in about ten minutes or less.

The quantity of food from day to day is given as follows: the first three days, 250 c.c. of warm milk, to which 15 gm. (one tablespoonful) of glucose is added, every two hours. This yields in feedings 1,528 calories.

On the fourth day, yolk of egg is added to the milk three times a day, an additional 174 calories — total in twenty-four hours, 1,702 calories.

If this is tolerated well, we can on the fifth and sixth days add one yolk of egg to each feeding, which supplies another 232 calories and makes a total of 1,934 calories.

4. Holzknecht: München med. Wchnschr., Sept. 29, 1914.
5. Lippman, C. W.: Simplification of the Duodenal Tube Examination, THE JOURNAL A. M. A., March 21, 1914, p. 911.

On the seventh day we add to three feedings the entire egg, the other feedings remaining the same — a total in twenty-four hours of 1,955 calories. If this is borne well, we give the patient an egg to each feeding on the eighth day — a total of 2,053 calories.

On the ninth day one tablespoonful of sweet cream is added to each feeding — a total of 2,350 calories in twenty-four hours. This quantity is kept up until duodenal alimentation is completed — until the end of the fourteenth day.

In some patients Einhorn encountered nausea, retching, even vomiting and diarrhea if cream or lactose was given in the beginning of the feeding. The reason for this is obvious. As the intestine is not accustomed to this kind of feeding, the cream necessarily causes irritation; lactose, besides being a mild laxative, is but slowly and not completely absorbed, and also causes irritation. It is best, therefore, to give the cream in the last days of feeding, and substitute glucose for the lactose. Should the cream even then cause diarrhea, it can be overcome by adding 0.5 gm. pankreon to each tablespoonful of cream. The deeper the tube is inserted, at least to 125 cm., the fewer chances are there for any of the unpleasant effects mentioned by Einhorn. This is achieved with the heavier weighted tube. Walking facilitates and hastens the desired progress of the tube.

Einhorn mentions that if the patient complains of excessive thirst, water can be introduced by the drop method through the duodenal tube, or normal saline by rectum. We find as a rule that the patient does not complain of any thirst, because he gets sufficient fluids with his milk. Besides this, 50 c.c. of water is used by us before each feeding to clean the tube, which gives the patient additional fluid of 350 c.c. in twenty-four hours. The sensation of thirst is due to the dryness of the mouth, which is easily overcome by having the patient rinse his mouth several times a day. The frequent cleansing of teeth and mouth is essential in order to prevent parotitis and its consequences. Other unpleasant sensations of the patient during feeding, like distention, peristaltic unrest, and even light cramps, have not been observed by us, owing to the fact that the feeding is not forced down by a syringe, which is absolutely necessary in a narrow tube, but is allowed to flow down through a glass funnel through the wider tube.

INDICATIONS FOR DUODENAL FEEDING

The indications made by Einhorn are mentioned above. We have thus far confined ourselves exclusively to the duodenal feeding of absolutely diagnosed cases of gastric or duodenal ulcer which have not yielded to the older methods of treatment. Let it be distinctly understood that the duodenal feeding has, in our opinion, by no means replaced the old reliable and well-established methods of internal treatment of gastric and duodenal ulcer. All methods—from the most conservative method of von Leube, through the manifold intermediary modifications to the most radical Lenharz method — have their special value and indications in individual cases. If, however, an ulcus treatment conscientiously carried out for one week does not relieve the symptoms at all, be it on account of atony, persistent acidity and secretions, or even because of the existence of adhesions, we institute the duodenal feeding.

After the tube is removed, the patient must not at once be allowed a liberal diet, even though he has no symptoms. We must bear in mind that the stomach, having received no food for such a length of time, must be educated gradually to nourishment. Again, while the secretions are at low ebb when the patient begins to eat, the tendency to hypersecretion and hyperacidity may still exist. Furthermore, one cannot absolutely foretell to what extent a florid ulcer has healed in the course of that time.

The first two days after the tube is removed, the patient receives milk with sweet cream and six eggs daily. On the third day, toast and butter and fine cereals are allowed. On the sixth day, the diet corresponding to the third week of the von Leube ulcer treatment is begun, and continued with the von Leube treatment until the end of the sixth week. Five days after removal of the tube, the patient is allowed to attend to his business. Should it happen that the symptoms recur when the patient goes on a more liberal diet, we go back to the fluid diet for a few days, and if that is ineffective another course of duodenal feeding can be tried for one week.

SUMMARY

We have in duodenal alimentation a very substantial addition to the old established methods of internal treatment of gastric and duodenal ulcer. The method is simple, and with the wider tube and the heavier weighted ball (Gross duodenal tube), introduction is hastened. Furthermore, the tube remains low down in the desired position, and feeding is readily accomplished. This mode of treatment is easily learned, and it can even be carried out in the house of the patient.

40 East Forty-First Street—3 East Eighty-Fourth Street.

QUININ AFTER OPERATION

EDMOND BONNOT, A.M., M.S., M.D.
AND
A. H. CLEVELAND, M.D.
ST. LOUIS

Since the preliminary report on "Quinin Salts in Postoperative Cases,"[1] we have used this method exclusively at St. Anthony's Hospital in 600 cases, comprising all operations requiring an ether anesthesia.

The technic has been slightly modified: Quinin muriate, 10 grains, dissolved in 2 ounces of water at 100 F., is given by rectum immediately after operation, followed by saline proctoclysis or (in septic cases) by 6 ounces of olive oil. The quinin is repeated every six hours for from four to six doses. In large or stout individuals, the first two doses are given four hours apart. In case saline proctoclysis is used, it should follow the quinin in about thirty minutes for best results.

The sulphate of quinin, by many repeated trials, has not proved so efficient as the muriate. The difference is probable due to solubility.

The postoperative backache is practically eliminated, and only about 2 per cent. suffer any gas pain to speak of. If such is present, one enema produces an efficient result when it is desired to move the bowels freely or to favor the passage of flatus. Gas is expelled spon-

1. Bonnot, Edmond: Quinin Salts in Postoperative Cases, THE JOURNAL A. M. A., Jan. 9, 1915, p. 146.